Spectrum of Gunshot Injuries in Civilian Practice at a Tertiary Hospital in a Semi-rural Community in Nigeria

A.C. Etonyeaku [1, 2], K.O. Ogundipe[3], C.A. Omotola[4], O.J. Ishola[5], O. Olasehinde[2], G.C. Obonna[5]

[1]Lecturer, Department of Surgery, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria.
[2]Department of Surgery, Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, Osun State Nigeria.
[3]Department of Surgery, Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria.
[4]Department of Surgery, Bingham University Karu , FCT Abuja, Nigeria.
[5]Department of Surgery, Federal Medical Centre, Owo, Ondo State Nigeria
Correspondence to: Dr. A.C Etonyeaku, Email: dretonyeaku@gmail.com

Background: ***Gunshot injuries are common. Political and ethno-religious conflicts have made injuries from ballistics now commonplace in Nigeria. Data was collected prospectively at Federal Medical Centre Owo, South Western Nigeria from September 2007 to August 2011. The objective was to highlight the nature of gunshot wounds, patients' and gun characteristics, and document the outcome of treatment upon discharge.***

Methods: ***All patients with gunshot injuries (GSI) admitted via the emergency room (ER) of the hospital. Outcome measures included the status upon leaving the hospital: Alive and discharged home without disability; alive and discharged home with some disability; discharged against medical advice; referral to another hospital and death. Data was analyzed using SPSS17 program for frequencies, measure of central tendencies and relationships.***

Results: ***A total of 139 patients were seen. Males accounted for 94.2% of the victims. The ages ranged from 12 to 70 years (mean = 33.14 years); modal age group was 21-40 years (76.3%). High velocity injuries were common (59%). Armed robbery (56.1%), accidental discharge (20.1%) and assault (11.5%) were major sources. Injuries involved the limbs (54.7%), trunk (10.1%), and > one region (22.3%). About 62% of cases presented within 8hours of injury. The mortality and limb deformity rates were 5.8% and 14.4% respectively. Outcome of treatment depended on promptness of definitive care and the nature of injuries at presentation (p= 0.001 and p=0.026 respectively).***

Conclusion: ***Injuries from high velocity guns were common. Armed robbery, assault and accidental discharge from law enforcement agents were the major sources. Outcome was dependent on the nature of injuries and the promptness of intervention.***

Keywords: Injuries, Civilian, Gunshot,

Introduction

The gun has undergone tremendous changes in design and sophistication since its invention about 1290AD. Similarly, the nature of injuries from its use has also varied from burns, due to gunpowder, to varying degrees of musculoskeletal and organ injuries. Guns were initially intended for warfare but their use has extended to civilian (non-war) practice. In civilian practice, guns are used for sports, games and aggression or defence from it[1,2]. With regional, political and ethno-religious conflicts, there has been proliferation of firearms in Africa. These firearms are either locally fabricated or imported from other continents. Initially intended for use in such conflicts, they invariably find use in the hands of criminals who use them in armed robbery, gangster or cult attacks, kidnappings, assassination bids and, lately, terrorism. In Nigeria, gunshot wounds (GSW) in civilian practice were very rare before the Nigerian civil war (1967-1970)[3]. Gunshot injuries can be fatal, and may be associated with lifelong disability. Management will involve rapid assessment, timely resuscitation, adequate and efficient treatment of injuries and effective rehabilitation where appropriate.

Literature is rife with accounts of gunshot injuries within and outside Nigeria[4-8].We aimed at adding to this body of knowledge, by sharing our experience and to see if there is any variation in pattern and outcome of treatment.

Patients and Methods

This was a prospective study done between September 2007 and August 2011 at the Federal medical Centre Owo, Ondo state south-west Nigeria. The hospital is a tertiary centre involved in the residency training programs in surgery and, orthopaedics and trauma of the national and West African post graduate medical colleges. It is located just off a major highway in a town (Owo) which is about equidistant on the road linking Lagos (Nigeria's major commercial hub) and Abuja (Nigeria's capital city). This highway also links the south-western Nigerian states and Onitsha (a major commercial city in south eastern Nigeria) through Edo state (the south-south) Nigeria. All patients admitted via the adult emergency room (ER) on account of gunshot wounds were recruited into the study. Patients with major vascular and severe head trauma associated with GSW who died before reaching the hospital were excluded from the study. Subjects were all initially resuscitated and evaluated using the Advanced Trauma Life Support (ATLS) protocol.

All the patients had therapeutic antibiotics and tetanus prophylaxis. After the secondary survey of the patients, information on bio data, source of injury, nature of injury including region(s) of body involved, type of gun used, injury arrival time, pre-hospital care, identity of those who brought the victim to hospital, the mode of transportation deployed when coming to the hospital, type of treatment given and outcome of treatment at the time of leaving the hospital, were entered into a prepared proforma from which a spreadsheet was generated. The data thus obtained was analyzed for frequencies and measures of central tendencies, chi^2 statistical significance and any correlation between variables using the SPSS 17.0 version.

Results

One hundred and thirty nine patients were managed within the study period. . There were more male victims (n= 131, 94.2%) with a male: female ratio of about 16:1. Age range was 12-70years with a mean age of 33.3years (SD± 10.15). The modal age group was 21-40years (table1) constituting 76.3% (n=106) of the patients. High velocity and low velocity guns were used in 59% (n=82) and 24.5% (n=34) of cases respectively while 16.5% (n=23) of patients were not sure of the type of the gun used. Armed robbery (n= 78, 56.1%), accidental discharge (n= 28, 20.1%), assault (n= 16, 11.5%) were major sources of injuries (table1). These injuries involved the limbs (n= 76, 54.7%), trunk (n=14, 10.1%), and more than one region in 22.3% (n=31) cases (table2). Soft tissue injury alone (excluding major neuro-vascular injury) constituted 61.9% (n=86) of injuries while fractures, thoraco-abdominal viscera and viscus injures comprise 30.9% (n=43), 1.4% (n=2) and 5.8% (n=8) respectively.

Most victims presented early at the hospital with 88 patients (63.3%) presenting within 8hours of injury, while 39 (28.1%), 5 (3.6%) and 7 (5.0%) patients were brought to the hospital >8hours but ≤24hours, >24hours but ≤72hours and >72 hours after injury respectively. There was no form of pre-hospital care in all patients managed. Seventy seven (55.4%) patients first presented at our facility following injury, while the remainder (n=62, 44.6%), were first seen at private hospitals or dispensaries before coming to our centre. Patients were brought to our hospital by relations and friends, law officers and sympathizers (passers-by) in 68 (48.9%), 21 (15.1%) and 50 (36%) cases respectively. Taxi cabs, private cars, van and motorcycles were the observed means of transport deployed to bring victims to the hospital in 40 (28.8%) 28 (20.1%) 15 (10.8%) and 56 (40.3%) cases respectively. Isolated soft tissue injuries without bony, viscera or viscus injury (61.9%) had wound debridement and dressing; and the wounds were made to heal by delayed primary closure or by secondary intention. Injuries involving fractures of the limbs (30.9%) had wound debridement with stabilization of fracture segments with external fixation. Chest injuries (n=5, 3.6%) had closed thoracostomy tube drainage with an underwater seal. Twenty five patients (18%) requiring thoracotomy and craniectomy for massive haemothorax and head injuries respectively were referred to centres where such services exists after initial resuscitation and stabilization.

Abdominal injuries (n=9, 6.5%) had exploratory laparotomy with drainage of haemoperitoneum with: repair of mesenteric injuries, closure of gut perforation and control of visceral (liver and splenic) bleeds as dictated by intra-operative findings. There were only two cases of splenectomy for splenic laceration not amenable to splenorraphy. Retroperitoneal haematomata noted at surgery were not explored as they non-expanding zone II and III collections. Twenty two patients had definitive surgical intervention within 24hours of arrival at the centre (table 3). Review of treatment outcome at discharge revealed mortality and limb deformity rates of 5.8% and 14.4% respectively (table 3). There was no statistically significant relationship between the outcomes of care at discharge on the one hand and the age of the patient (p= 0.172), injury arrival time (p=0.782), type of gun used (p=0.402), and source of gunshot injury (p=0.299).

Table 1. The Distribution of Source of Injury and Type of Gun amongst Various Age Groups

		Age Groups No (%)						
		<20	**21-30**	**31-40**	**41-50**	**51-60**	**>60**	**Total (%)**
Type of gun No (%)	**Source of Injury**							
High velocity 82 (59)	Robbery	3	17	14	10	3	1	**48 (34.5)**
	Assault	0	4	2	2	0	1	**9 (6.5)**
	Accidental discharge	3	11	4	1	0	0	**19 (13.7)**
	Communal skirmishes	0	4	2	0	0	0	**6 (4.3)**
	Sub-total	***6***	***36***	***22***	***13***	***3***	***2***	***82 (59)***
Low velocity 34 (24.5)	Robbery	1	6	5	4	0	0	**16 (11.5)**
	Assault	0	1	3	1	0	0	**5 (3.6)**
	Accidental discharge	0	2	2	0	0	1	**5 (3.6)**
	Communal skirmishes	0	1	2	1	0	0	**4 (2.9)**
	Self	0	4	0	0	0	0	**4 (2.9)**
	Sub-total	***1***	***14***	***12***	***6***	***0***	***1***	***34 (24.5)***
Not sure 23 (16.5)	Robbery	0	8	6	0	0	0	**14 (10.1)**
	Assault	0	0	2	0	0	0	**2 (1.4)**
	Accidental discharge	0	1	3	0	0	0	**4 (2.9)**
	Communal skirmishes	0	2	0	1	0	0	**3 (2.2)**
	Sub-total	***0***	***11***	***11***	***1***	***0***	***0***	***23 (16.5)***
	Summary							
	Robbery	4	31	25	14	3	1	**78**
	Assault	0	5	7	3	0	1	**16**
	Accidental discharge	3	14	9	1	0	1	**28**
	Communal skirmishes	0	7	4	2	0	0	**13**
	Self	0	4	0	0	0	0	**4**
	Grand total	**7 (5)**	**61 (43.9)**	**45 (32.4)**	**20 (14.3)**	**3 (2.2)**	**3 (2.2)**	**139 (100)**

Table 2. Regions of the Body Injured with Respect to the Source of Gunshot

Region	Source of Gunshot					Total No (%)
	Robbery	Assault	Accidental discharge	Communal skirmishes	Self	
One upper limb	12	1	5	1	4	23 (16.5)
Both upper limb	1	0	0	0	0	1 (0.7)
One lower limb	24	4	9	4	0	41 (29.5%)
Both lower limb	5	1	1	0	0	7 (5)
Upper & lower limbs	2	1	1	0	0	4 (2.9)
Head & Neck	7	1	2	1	0	11 (7.9)
Chest	2	1	1	1	0	5 (3.6)
Abdomen	5	1	2	1	0	9 (6.5)
Perineum & buttocks	0	0	2	0	0	2(1.4)
Back	4	0	1	0	0	5 (3.6)
More than 1 region	16	6	4	5	0	31 (22.3)
Total No (%)	**78 (56.1)**	**16 (11.4)**	**28 (20.1)**	**13 (9.5)**	**4 (2.9)**	**139 (100)**

Table 3. Relationship between the Time Interval from Admission to Definitive Treatment and the Outcome at Discharge

Outcome	Duration from admission to surgery (Days)				Total No (%)
	<1	1-<7	7-28	>28	
Alive + well + discharge	11	28	23	12	74 (53.2)
Alive +deformity + discharge	1	7	6	6	20 (14.4)
DAMA	5	13	1	0	19 (13.6)
Died	3	3	2	0	8 (5.8)
Referrals	2	14	2	0	18 (13)
TOTAL	**22**	**65**	**34**	**18**	**139 (100)**

P value= 0.001 (significant at p= <0.05)
DAMA= discharge against medical advice

On the other hand, however, there exist a significant relationship between the outcome and associated injuries (p=0.026) and the interval between admission and definitive care (p=0.001).

Discussion

Gunshot wounds (GSW) are common in modern day surgical practice, and its prevalence is expected to be more in times of war and communal skirmishes. It tends to occur more in males as was noted in this study; this is in tandem with previous reports by earlier researchers[9]. The reason advanced for this

is that males are more adventurous, prone to taking risks and perhaps more aggressive in bullying or defence [9, 10]. About 81% of victims were less than 40 years old, and almost 96% were less than 50 years of age. Our finding again is similar to that reported in Ibadan, Nigeria[11]. This age groups represents the productive workforce, thus injuries from gunshot is expected to have some socioeconomic import on the victims, their relations and by extension, the country. These costs are not just for treatment but also the man-hours lost during care or in event of death or permanent disability [12,13]. Vulnerability of these age groups was also noted in the review autopsy reports from ballistic missiles by Seleye-Fubara et al[14].

We noted that the use of high velocity guns was very common (59%) when compared with low velocity guns (24.5%). Ogunlusi et al[15], in a study done in the same region (south- western Nigeria) in 2006, reported that 63.1% of patients with GSW had their injuries from Dane (locally made, low velocity) guns. There was yet a sizeable population of victims (16.5%) who are not sure of the kind of gun used. Most patients in this group were victims of robbery attacks, accidental firearm discharge or assault. They may have been hit by stray bullets, or the fright experience at the time of the attack may not have permitted notice of the nature of the firearm used. Several reasons have been advanced for possession of firearms which include: defence, sports and games[16]. In some countries ownership of personal gun(s) is quite common[16]. This practice is not common in our environment as there are stringent regulations governing acquisition and use of gun(s) [17,18]. Armed robbery topped the list of motives behind the injuries; and this has been previously noted[19].

Our centre is just off a major highway linking south-western Nigerian states and the north central south-south-south and eastern states. Traders commuting along these routes are potential targets. The centre is also within 30 km radius of two tertiary schools and thus often receives victims of cult/ gang related violence. Assaults from secret cult clashes in tertiary schools and assassination bids were common as was celebratory gunshot wounds. The latter are accidental GSW occurring during festivals and celebrations (especially funeral rites); and may involve self inflicted injuries or a second party. This phenomenon was also noted by Ogunlusi et al [21] in their review. All self inflicted wounds were from hunting expeditions; there was no case of GSW from suicidal attempt as was the case in earlier reports [22]. Worrisome was the high rate of 'accidental discharge' from police service riffles; similar high rate was reported in Calabar, south-south Nigeria[20].

Anecdotal reports indicate that injuries occur following arguments between the law agents and the victims or some other concerns. The victims of such violence may be passers-by or those hit by stray bullets. Injuries majorly affected the limbs (54.6%); with exclusive lower limb involvement in 34.5% of times. This is similar to findings by Obalum, Giwa and Ogo[23] in Lagos Nigeria. We concur with Udosen et al[20] and Persad et al [24] that these injuries may have been aimed at intimidating, demobilizing and subduing the victims and not primarily aimed at killing,. Head and neck (7.9%), trunk injuries (10.1%) and multiple sites (22.3%) were common from communal clashes, assault/ assassination bids and armed robbery; and could have been primarily aimed at killing the victim (Table2). Injuries to the back and buttocks could have been sustained during escape bids. There had been contradictory positions in definitions and management of gunshot wounds [25]. Injuries are dependent on the bullet (make and design), its velocity and entrance profile, its interaction with the tissue in terms of energy transfer, and the tissue properties. This has been encapsulated in the findings by Bartlett et al [26]. High velocity missiles may have low energy transfer while low velocity missiles may prove fatal [27, 28].

Isolated soft tissue injuries without bony, viscera or viscus injury formed the bulk of cases managed. These required wound debridement and dressing to heal by secondary intention or by delayed primary closure. Fractures were common and involved mainly the limbs and ribs in chest trauma. Limb injuries had wound excision with stabilization of fracture segments; while chest injuries had closed thoracostomy tube drainage with an underwater seal. Patients requiring thoracotomy and craniectomy for head injuries were referred to centres where such services exist after resuscitation and stabilization. These make up 18% of cases seen. Abdominal injuries had exploratory laparotomy with

drainage of haemoperitoneum, repair of mesenteric injuries, closure of gut perforation and control of visceral (liver and splenic) bleeds. There were only two cases of splenectomy for splenic laceration not amenable to splenorraphy. Retroperitoneal haematomata noted at surgery were not explored.

Early presentation by patients after sustaining GSW had been noted by earlier researchers[4,5,7]. We also found that majority of our patients presented early, this may be due to the location of the hospital and the timing of event. The hospital is close to the highway and yet within the town; which has a fairly good access road for a semi rural setting. Most of the event occurred during the early hours (towards dawn) and at dusk; periods when transportation to hospital can be arranged. All the patients never had any form of pre-hospital care; and majority of them were brought straight to the hospital. This may also have been responsible for the early presentation. All patients with injuries to the head and neck region, chest and abdomen presented within 8 hours of injury.

The 10.8% of cases presenting after 24 hours of injury had predominantly soft tissue and bone injuries. We observed that there was no form of pre-hospital care in all the patients. In our setting, there are no trained paramedics and till lately ambulance services evacuating trauma victims from site of injuries were virtually non-existent. This accounts for the means of transportation deployed in bringing patients to the hospital. Most of the patients survived and were discharged with no deformity; this probably is due to the nature of their injuries: which were predominantly soft tissue, or early presentation with prompt definitive care. The mortalities recorded were from multiple wound involving the chest, abdomen and head and neck region.

It is noteworthy that some patients (13.6%) opted for alternative medical (traditional) care forming the 'discharged against medical advice (DAMA)' group. These patients believe in the ability of the alternative medical practitioners to extract the bullet by non surgical means like incantations and conjure. Nasir and Babalola[29)] reported a DAMA prevalence of 4.2% amongst trauma patients in a surgical emergency room; and for their patients, they noted that desire to try un-orthodox therapy and lack of financial support to orthodox care were the major reasons for DAMA. We did not seek to interrogate the rationale for DAMA amongst this group. Outcome of treatment for this group of patients from the alternative source of care is not known, and was not evaluated. Osime and Elusoji[30] reported a series with high morbidity and mortality amongst patients with GSW that opted to alternative (un-orthodox) medical care. They also revealed high levels of exploitation of these patients by these alternative medical practioners. Our study asserts that the nature of the GSW should guide therapy and not the velocity or type of gun. This association when combine with pragmatic surgical interventions formed the determinants of favourable outcome in our series.

Conclusion

Gunshot wounds are common, and commonly follow armed robbery and assault (assassination bids, and gangster/ secret cult activities). They may also occur following poor handling of firearms as in accidental self (non-suicidal) injuries and police accidental and collateral injuries. Irrespective of means of injury, the outcome of wound care depends on tissue damaged (nature of injuries) and not on the nature of the weapon used. Early treatment outcome also depends on the promptness of definitive treatment. We advocate that the nature of the wound should dictate management protocol and not the nature of weapon.

References

1. Cook PJ, Ludig J: Guns in America; Results of a comprehensive National Survey on firearms use, summary report. Washington DC Police report 1997.
2. Hemenway David, Azrael Deborah. The Relative Frequency of Offensive and Defensive Gun Use: Results of a National Survey. Violence And Victims 2000; 15:257-272
3. Ohanaka EC, Iribhogbe EP, Ofoegbu RO. Gunshot injuries in Benin City. Nig J of Surg Sc. 2000;2:81–85.
4. Adisa AC, Agu A. Gunshot injuries in Aba. JOMIP 2008;7:23-5.

5. Mohammed AZ, Edino ST, Ochicha O, Umar AB. Epidemiology of gunshot injuries in Kano, Nigeria. Nig J Surg Res 2005;7:296-9.
6. Adesunkanmi AR, Lawal R. The pattern and outcome of civilian gunshot injuries in adults in rural and semi-urban Nigerian communities. Injury Extra 2007;38:104-5.
7. Saidi HS, Nyakiamo J, Foyas. Gunshot injuries as been at the AgaKhan Hospital, Nairobi, Kenya. East Afr. Med Jour. 2002; 79: 188 – 1892.
8. Softah AL, Eid Zahrani M, Osinowo O. Gunshot injuries in adults in the Abha region of Saudi Arabia.Afr J Med Med Sci. 2002 Mar;31(1):41-4.
9. Osime C, Kpolugbo J. Pattern and outcome of penetrating injuries in Irrua, a sub-urban community in Nigeria. Afr J Trauma 2004;2:40-2.
10. Makite I, Pibkijamaki NJ. The fatal firearm injuries in Finland: A nationwide survey. *Scand J Surg* 2000; **91:** 329-331.
11. Afuwape O, Alonge T. An audit of gunshot injuries seen in the accident and emergency department of a Nigerian tertiary hospital. WAJM 2006;25:295-7.
12. Allard D, Burch VC.The cost of treating serious abdominal firearm-related injuries in South Africa. S Afr Med J. 2005; 95:591-594.
13. Cook PJ, Lawrence BA, Ludwig J, Miller TR. The medical costs of gunshot injuries in the United States. JAMA. 1999; 282: 447-454.
14. Seleye-Fubara D, Etebu EN, Bob-Yellowe E. Pathology of firearm mortalities in the Niger Delta region of Nigeria: a study of 136 consecutive autopsies. Med Sci Law January 2009 vol. 49 no. 1 51-55.
15. Ogunlusi JD, Oginni LM, Ikem IC, Olasinde A A, Hamilton OG, Akinbolagbe AM, Temitope M. Gunshot injuries in a Nigerian hospital Nig J Orth Trauma 2006;5:34-7.
16. Hemenway, David; Miller, Matthew; Azrael, Deborah. "Gun Use in the United States: Results from Two National Surveys." Injury Prevention. 2000; 6:263-267
17. Karp, Aaron.2007.'Completing the Count: Civilian firearms.' Small Arms Survey 2007: Guns and the City.Cambridge:Cambridge University Press,27 August.
18. Nigeria.1990.'Licensing.' Firearms Act, Chapter 146, Laws of the Federal Republic of Nigeria 1990.Abuja:Federal Republic of Nigeria,1 January.
19. Abbas AD, Bakari AA, Abba AM. Epidemiology of armed robbery-related gunshot injuries in Maiduguri, Nigeria. Niger J Clin Pract 2012;15:19-22.
20. AM Udosen, AU Etiuma, GA Ugare, and OO Bassey: Gunshot injuries in Calabar, Nigeria: an indication of increasing societal violence and police brutality. Afr Health Sci. 2006 September; 6(3): 170–172.
21. Ogunlusi JD, Oginni LM. Death From Celebratory gunshot injuries. Internet J Surg 2006;8: ISSN 1528-8242.
22. Balci Y, Canogullari G, Ulupinar E. Characterization of the gunshot suicides Journal of Forensic and Legal Medicine Volume 14, Issue 4, May 2007, Pages 203–208
23. Obalum DC, Giwa SO, Ogo CN. Pattern of extremity gunshot injuries seen in Lagos University Teaching Hospital, Lagos, Nigeria. Nig Q J Hosp Med. 2007 Oct-Dec; 17(4):140-3.
24. Persad IJ, Reddy RS, Saunders MA, Patel J. Gunshot injuries to the extremities: Experience of a U.K. trauma centre. Injury 2005;36:407-11.
25. Fackler ML. Civilian gunshot wounds and ballistics: dispelling the myths. Emerg Med Clin North Am. 1998 Feb;16(1):17-28.
26. Bartlett CS, Helfet DL, Hausman MR, Strauss E: Ballistics and gunshot wounds: effects on musculoskeletal tissues. J Am Acad Orthop Surg 2000, 8:21-36.
27. Molde A, Gray R. High-velocity gunshot wound through bone with low energy transfer. Injury 1995; 26:131.
28. Ordog GJ, Wasserberger J, Balasubramaniam S: Shotgun wound ballistics. J Trauma 1988, 28:624-631.
29. Nasir AA, Babalola OM. Clinical spectrum of discharges against medical advice in a developing country. Indian J Surg 2008;70:68-72.
30. Osime OC, Elusoji SO. Outcome of management of gunshot injuries by Nigerian tradional doctors. Pak J Med Sci 2006;22:316-9.